Weather and faults in the UK telecommunications infrastructure

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Introduction

The telecommunications system is a critical part of the UK infrastructure. It underpins many business and social activities, with reliance on the network ever increasing. Within the UK, the majority of the network is maintained and operated by the BT group. The physical parts of the network are exposed to the elements and as a consequence are known to be prone to weather-related faults. For example, high levels of precipitation in 2013 led to increased faults nationwide (BT Group 2013). These faults affect customer service levels and drive up the cost of operating the network. The unpredictable nature of the weather, in conjunction with uncertainty over projected climate change and extreme weather pose a significant risk to the network. Therefore a model that links weather and faults could help to identify and quantify these risks.

Project Aims

- Investigate the key weather drivers that affect faults in the UK telecommunications system. Understand the link between weather and faults to create an impact model that can be used to assess future weather impacts.
- Identify medium range weather forecasts which can predict the weather variables used in the impact model with skill.
- Represent the uncertainty in ensemble forecasts (figure 1) used to predict the future fault rates as probability distributions which can be used to inform business decisions.
- Identify the effects of extreme weather events on the network and explore the possibility of predicting them.

Methodology

Historical data are being used as a basis to construct the impact model. The models being tested are initially being selected through backwards step wise regression and assessed using cross validation. To date, a very simple model has been constructed using linear regression to plot three variables (figure 2).

Further work

- Link the impact model to medium term weather forecasts at different time scales for between 1 week to seasonal. Assess the economic value that these predictions.
- Integrate probabilistic fault data effectively within Openreach as a tool used for planning.
- Work with Openreach to calculate thresholds for a cost/loss functions decision, enabling economic benefits to be maximized.
- Evaluate the long term effect climate change may have on the network under different emission scenarios.

References


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Figure 1. An example ensemble forecast from the European Centre for Medium-range Weather Forecasts (ECMWF) showing the ensemble spread of temperature anomalies in the ocean (ECMWF, 2014)

Figure 2. An example plot of the simple linear model used to predict fault rates from 3 different weather variables: precipitation and two measures of temperature.